Unmanned Ground Vehicles: Tireless Warrior or Unrealistic Expectation?

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Unmanned Ground Vehicles:

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PROMISING TECHNOLOGY

The current technological revolution within the U.S. military has grown at a rapid pace. New command and control systems, precision delivered munitions, and improved digital targeting systems are but a few of the technologies currently being used in the Global War on Terror. These systems are aimed at transforming the U.S. military into a 21st century fighting force, taking advantage of the ever advancing world of modern technology development. Within this revolution lie little known research and development programs aimed at delivering systems commonly referred to as unmanned ground vehicles, or UGVs. UGVs are arguably one of the most "transformational" technologies since the airplane.[1] If developed properly, UGVs equipped with special cameras and sensors will afford tactical units the ability to not only locate the enemy, but to also one day assist in the responsive targeting and engagement of enemy combatants on the ground. They will do this day and night, in any weather, in all environments, without fear and without the overriding concerns about the potential loss of human life. This capability would afford new, unexplored concepts in how Marines and Soldiers fight on tomorrow's battlefield, as well as provide decision makers more latitude when

weighing considerations of sending troops into harm's way. There will be much less hesitance at sending a machine to look around a corner in a hostile urban battlefield to see where the enemy is. To achieve this technological leap, several critical issues in the development path of UGVs must be researched in order to ensure future doctrinal integration and operational success. UGVs are currently in use in Iraq, but are relegated mainly to explosive ordnance disposal missions. Future UGVs, based on current development programs, will result in systems used in reconnaissance, surveillance, and target acquisition, logistical support, and even casualty recovery and evacuation missions.

CURRENT PLANS

The threat facing U.S. security at home and abroad is determined, and requires sending troops into harms way almost on a daily basis. With these deployments comes the trepidation that many troops will not return home to their families. Political pressure is always present to provide our troops with the best possible equipment and training in hopes of reducing the inherent danger they face in combat. In the not so distant future, troops heading into areas similar to Fallujah and Mosul may have a marked advantage over their enemy. If technology prevails, tireless UGVs

will scour the battlefield, searching, locating, and destroying the enemy, all the while keeping the operator in a hidden, safe location. In an effort to bring this unmanned capability to fruition, the National Defense Authorization Act of Fiscal Year 2001, included a stated goal for the U.S. military to have one-third of operational deep strike aircraft unmanned by 2010; and by 2015, one-third of operational ground combat vehicles unmanned.[2] An optimistic goal, this effort is resulting in growing experimental prototype UGV system development within all branches of the armed forces. Of all the services, the U.S. Army has taken the lead in the development of UGVs under the Future Combat Systems (FCS), a program initiated in order to develop network centric concepts using unmanned systems.[3] From 2004 through 2009, $500 million, out of a $13.7 billion dollar FCS budget will be spent developing a family of UGVs.[4] This family will consist of a small, roughly thirty-pound “Soldier” UGV, a “Mule” UGV weighing 2.5 tons, and a six-ton armed reconnaissance vehicle.[5] Each will provide its own specific mission capabilities at different echelons aimed at “enhancing” the warfighting capability of the units it resides in. The key word is *enhancing* capabilities, not so much as replacing the man on the ground. Many individuals in military circles are

skeptical about the efficacy of UGV use at the tactical level. Reasons abound, to include fears of manpower reductions as machines take over, or a complex, slow system, that limits the speed and tempo a unit may generate when conducting a mission. The fear of manpower reduction may stem from looking at the industrial robotics model where it's aimed at increasing production levels, with the byproduct being the elimination of human workers, and jobs. For military applications, robots, specifically UGVs, are aimed at enhancing mission capabilities by equipping units with systems that are fearless, untiring, and capable of going into austere locations where human access or presence is impractical or unsustainable.[6]

There are concerns that lie in the infancy of today's autonomous UGV functionality, in that the initial systems procured and fielded will be operator intensive, and they will force warfighters to focus on other tasks, vice the job at hand of staying alive on the battlefield. To increase our warfighting capabilities across the spectrum of conflict with the involvement of unmanned missions/systems, autonomy will play an integral role in achieving success.[7] The eventual goal of FCS, and other research and development programs being run in our national and military labs, and in agencies like the Defense

Advanced Research Projects Agency (DARPA), is to integrate numerous unmanned systems under a single network. A network of sensors, unmanned aerial vehicles, and UGVs that will provide persistent, increased situational awareness that enhances the effectiveness of each of the warfighting functions, no matter what the operational environment may be.[8] Common software, operator interfaces, controls, and shared frequencies are a few of the requirements that lie ahead for the many developers of these systems, and the institutions planning to develop unmanned doctrine.

ISSUES AT HAND

There are several issues that could lead to serious delays in providing a UGV that is accepted by its users, functions in a way that increases their warfighting capability and is reliable. One of these issues concerns frequency bandwidth. Bandwidth that affords multiple UGVs (and other unmanned systems) operating collectively, simultaneously, and one day autonomously, in close proximity to one another. Current and future R&D programs need to examine not only the mechanical, robotic aspects of UGV development but also the issues associated with bandwidth usage and allotment. The frequency spectrum is limited in physical availability, and is especially true regarding available frequencies allotted to military UGV

use where future concepts have multiple unmanned systems linked and running simultaneously within a network. This poses a serious challenge that requires research to identify viable options and potential alternatives. At present, there are little to no funds appropriated for this research. Therefore, many of the systems developed under the FCS umbrella and other peripheral programs could find themselves limited in their ability to network with one another in providing the fused, reliable, time sensitive information military planners require when prosecuting targets in urban environments. Shared networks and autonomous battlefield systems may be an achievement that never materializes if not properly researched with regards to available bandwidth/frequency allocation.

Another more troubling concern regarding UGVs is the development of lethal systems and payloads. Some of these payloads are being developed for UGVs that are still prototype in design and lack operational evaluation. These payloads are focused with a man-in-the-loop interface for safety consideration. If the U.S. military develops UGVs using the unmanned aerial vehicle (UAV) model, lethal payloads would come at a much later stage in the developmental cycle. Once the UAVs were developed to a point where they were technologically mature and relatively

reliable, payloads aimed at delivering lethal munitions were introduced and employed within a limited scope. This was the case in the Predator UAV engagements in Operation Enduring Freedom.[9] Developers and program managers may be taking a risky step in pushing for lethal UGVs so soon, while they are still within their apparent infancy. Fratricide and non-combatant engagements would cause serious ramifications to the progress of UGV development should these scenarios become a reality. It's known that even with a finger on the trigger and using eyesight, humans still fall short at identifying targets in the fog of war. At present, the reliance on electro-optic systems and electronic situational awareness through a UGV when delivering lethal munitions is too big a gamble at such an early stage in UGV development, and should be left to later planning.

It should serve as a notice to UGV program managers determined on developing lethal payloads that if agencies like DARPA are just now beginning to examine the metrics of lethal UGVs used in combat scenarios, the reality of lethal systems is still years out. DARPA is well known for conceptually and technologically working well into the future. The DoD might be safer and smarter in focusing on finding the enemy first with UGVs, similar to UAV history.

For years, UAVs were used for reconnaissance, surveillance, and target acquisition, before flying missions where they would be asked to engage a target by lethal means. Developers, program managers, and potential users gained an understanding of the system's capabilities and developed appropriate tactics, techniques, and procedures prior to giving the UAV the lethal mission. Learn how to better locate the enemy with UGVs first, then at a later time, conceive ideas on how to kill him.

CLOSING

To successfully transition UGVs into the U.S. military, the issues of available frequency/bandwidth and common programming architecture need to be researched. In addition, lethality development should be left to groups like DARPA, and given time to mature in an academic setting, not prematurely pushed into operational use and run the risk of friendly loss of life. Future doctrinal integration and operational success can be met if program managers and decision makers realize the value of UGV use in future combat operations, and focus research on the larger issues such as the ones discussed within this paper. Having a tireless warrior like a UGV would provide a real capability to the warfighter of the future. A system that has no fear, and can be used in a one-way mission if need

be. If technology development of UGVs is paced appropriately with a doctrinal plan, tactics, techniques and procedures of troops using UGVs will be available. This currently does not exist and will result in systems delivered with directions for use and trouble shooting, but lacking in any proven methods of employment.

NOTE: The author served as the Unmanned Ground Vehicle Project Officer, Reconnaissance Surveillance, Target Acquisition Branch, Technology Division, Marine Corps Warfighting Lab, Quantico, Virginia, from August 2001 through August 2004.

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